Appendix C

GEOTECHNICAL RECONNAISSANCE REPORT

GEOTECHNICAL RECONNAISSANCE REPORT

PLAZA CAMINO REAL SHOPPING CENTER REVITALIZATION CARLSBAD, CALIFORNIA

GEOCON
INCORPORATED
GEOTECHNICAL
CONSULTANTS

PREPARED FOR

HELIX ENVIRONMENTAL PLANNING, INC.
LA MESA, CALIFORNIA

JANUARY 28, 2010
PROJECT NO. G1180-32-01

Project No. G1180-32-01
January 28, 2010

Helix Environmental Planning, Inc.
7578 El Cajon Boulevard, Suite 200
La Mesa, California 91942

Attention: Ms. Kim Baranek

Subject: PLAZA CAMINO REAL SHOPPING CENTER REVITALIZATION
CARLSBAD, CALIFORNIA
GEOTECHNICAL RECONNAISSANCE REPORT

Dear Ms. Baranek:

In accordance with your authorization of our Proposal (LG-09249 dated October 15, 2009), we have prepared this geotechnical reconnaissance for the Plaza Camino Real Shopping Center revitalization project in Carlsbad, California. The accompanying report describes the site soil and geologic conditions, discusses potential geotechnical constraints and geologic hazards, and provides recommendations for a future geotechnical investigation.

Should you have questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Trevor E. Myers
RCE 63773

David B. Evans
CEG 1860

REGISTERED PROFESSIONAL ENGINEER
TREVOR E. MYERS
No. RCE63773
Exp. 09/30/10
CIVIL
STATE OF CALIFORNIA

PROFESSIONAL GEOLOGIST
DAVID B. EVANS
No. 1860
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

TEM:DBE:dmc

(6) Addressee

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GEOTECHNICAL RECONNAISSANCE REPORT

1. PURPOSE AND SCOPE

This report presents the results of a geotechnical reconnaissance for the proposed Plaza Camino Real shopping center revitalization and expansion project in Carlsbad, California (see Vicinity Map, Figure 1). The purpose of this study is to provide preliminary soil and geologic information for the property, identify known geologic hazards that may adversely impact the proposed development and assist in planning and development studies.

The scope of our study included a review of readily available published geologic literature and geotechnical reports relative to this property and the vicinity, and performing a site reconnaissance and preliminary geologic mapping where possible.

2. SITE AND PROJECT DESCRIPTION

Plaza Camino Real is an existing regional shopping center located on an approximately 93-acre site bounded by El Camino Real to the east, State Route 78 and Buena Vista Creek to the north, Marron Road to the south, and Monroe Street to the west in Carlsbad, California.

The site was originally developed in the late 1960's and subsequently expanded several times to its current configuration. The two to three story shopping center buildings are situated in the central portion of the site with a significant grade break traversing in an east-west direction dividing the upper southerly one-third of the site from the lower northerly two-thirds of the site. Peripheral parking consisting of approximately 6,400 parking stalls surrounds the central mall stores. Five existing outparcel buildings occupy portions of the parking lot area.

We understand that re-development consists of demolition, reconfiguration and/or reconstruction of approximately 179,600 square feet of existing area and the construction of up to approximately 35,400 square feet of new gross leasable place. It appears that the improvement will be accomplished by expanding several of the existing buildings and construction of four new structures in the southeast portion of the property. The new structures will provide retail space, restaurant pads, a theater and grocery/market or other retail/lifestyle/entertainment commercial uses.

From a geologic standpoint, the subject site is situated on reclaimed marshland in the Buena Vista lagoon area approximately 1 mile from the Pacific Ocean. The site is located relatively close to the southern boundary of the lagoon, where relatively steep slopes ascend from the lagoon to an elevated terrace several hundred feet above the shopping mall. Santiago Formation has been mapped along the southern flanks of the property. The elevation of the lagoon prior to site development ranged from approximately 5 to 10 feet (MSL). Grading for the mall resulted in placing compacted fill across the

lagoon area to achieve pad grade elevations ranging between approximately 26 and 38 feet (MSL). The topographic relief across the property ranges from approximately 10 feet along the northwestern edge of the parking lot to approximately 44 feet along the southeastern edge.

The Site Plan (Figure 2), which utilized a Google Earth image as the base map, depicts the current configuration of the subject property and existing improvements. We added the approximate overall project limits and locations of proposed improvements.

3. SOIL AND GEOLOGIC CONDITIONS

Based on our literature review and site reconnaissance, the site is generally underlain by either compacted fill over alluvium or Santiago Formation. The thickness of the alluvium is expected to be nominal to the south where the formational materials are expected. The geologic units are described in detail below.

3.1 Compacted Fill

Compacted fill soils have been placed across portions of the property during the original site grading in the late 1960's/early 1970's to achieve the current grades (Reference No. 9). The fill soils range in thickness from 0 feet in the southeastern portion of the site to approximately 35 feet in the western and northwestern portions of the property. The fill soils generally consist of clayey sands, silty sands, silty clays and sandy clays and typically exhibit a "low to medium" expansion potential. The fill materials were most likely placed to raise the existing grades out of the lagoon /floodplain zone.

3.2 Alluvium

Alluvial soils underlie the fill materials across portions of the site. These bay-estuary deposits generally consist of loose to medium dense, silty fine sands and clayey sands, and soft to firm clayey silts and silty and sandy clays. The alluvial deposits are considered potentially compressible and subject to consolidation under increased loading. The estimated alluvial thickness ranges from 0 feet in the southeastern portion of the property to greater than 100 feet in the northwestern portion of the site (Reference No. 9).

The settlement potential of the alluvial materials should be evaluated during future geotechnical studies. In addition, there are layers of potentially liquefiable soil below the groundwater level based on Reference No. 9. Evaluation of the soil liquefaction potential will be required during future geotechnical studies.

3.3 Santiago Formation

The Eocene-age Santiago Formation was mapped along the southern flanks of the property and is expected to be encountered along the southern and southeastern portions of the property. The Santiago Formation generally consists of relatively flat-lying claystone, siltstone, and sandstone units. Weak, waxy claystone and thinly laminated siltstone/claystone and sandstone are typically present within this unit. With the exception of the sandier portions of the Santiago Formation, materials derived from this unit typically posses a medium to high expansion potential with a moderate to low shear strength. The Santiago Formation typically has a high to moderate potential to transmit seepage along impervious layers within the formation.

The Santiago Formation often exhibits highly cemented zones that may result in excavation difficulty during grading and construction of site improvements (e.g., underground utility lines and building foundations). Moderate to heavy ripping may be necessary in portions of this formation to facilitate excavation. Generation of oversize materials requiring special handling and placement techniques often occurs when excavating in this formation.

4. GROUNDWATER

Based on Reference No. 9, the depth to groundwater is estimated to be approximately 13 to 15 feet below ground surface. Groundwater could have a significant influence on construction depending on the location of proposed underground utilities and excavation depths. Stabilization and/or dewatering techniques will likely be necessary for excavations greater than approximately 13 below existing grades, especially along the northern and northwestern portions of the property where the compacted fill and alluvial materials are present. Groundwater elevations may vary seasonally and may also be influenced by the presence of water in the Buena Vista channel located along the northern boundary of the site. Proper surface drainage of irrigation and rainwater will be critical to the future performance of the project.

5. GEOLOGIC HAZARDS

5.1 Landslides

No evidence of landsliding was noted during the reconnaissance or previous investigation, and no landslides are known to exist on the property or at a location that would impact the proposed development.

5.2 Regional Faulting and Seismicity

Based on review of aerial photographs and published geologic maps, the site is not located on any active or potentially active fault trace, as defined by the California Division of Mines and Geology. In order to determine the distance of known faults to the property, the computer program *EQFAULT*

(Blake, 2000) was utilized. In addition to fault location, *EQFAULT* was used to estimate ground accelerations at the site for the maximum anticipated seismic event. Regional geologic information (Reference No. 5) is presented in Figure 3.

The results of the deterministic analysis indicate that the Newport-Inglewood (off-shore segment) and Rose Canyon Faults are the dominant sources of potential ground shaking at the site. The Newport-Inglewood and Rose Canyon Faults are estimated to have the capability to generate a maximum earthquake event of Magnitude 7.1 and 7.2, respectively. The estimated maximum peak site acceleration was calculated to be 0.34g. Presented on Table 5.2 are the earthquake events and calculated peak site accelerations for the faults most likely to subject the site to significant ground shaking. Peak ground acceleration was estimated using the attenuation relationships of Sadigh (1997).

TABLE 5.2
DETERMINISTIC SITE PARAMETERS FOR SELECTED ACTIVE FAULTS

Fault Name	Distance From Site (miles)	Maximum Magnitude Event	
		Magnitude	Peak Site Acceleration (g)
Newport-Inglewood (Offshore)	5.8	7.1	0.34
Rose Canyon	6.2	7.2	0.34
Coronado Bank	22.4	7.6	0.17
Elsinore (Temecula)	22.7	6.8	0.11
Elsinore (Julian)	23.1	7.1	0.12
Elsinore (Glen Ivy)	32.1	6.8	0.07
San Joaquin Hills	34.5	6.6	0.07
Palos Verdes	35.8	7.3	0.09

It is our opinion that the site could be subjected to moderate to severe ground shaking in the event of an earthquake along any of the faults listed on Table 5.2 or other faults in the southern California/ northern Baja California region. However, the site does not possess any greater seismic risk than that of the surrounding developments.

5.3 Soil Liquefaction and Lateral Spread Potential

Liquefaction typically occurs when a site is located in a zone with seismic activity, on-site soils are cohesionless, groundwater is encountered within 50 feet of the surface, and soil relative densities are less than about 70 percent. If the four previous criteria are met, a seismic event could result in a rapid pore-water pressure increase from the earthquake-generated ground accelerations. Seismically induced settlement is settlement that occurs as a result of liquefaction, or as a result of partial re-arrangement in loose dry sands located above the groundwater table.

The County of San Diego Hazard Mitigation Plan maps identify zones of high risk for liquefaction in areas throughout the county. The northern portion of the subject property is included in a high-risk hazard area based on their mapping. The potential for liquefaction and seismically induced settlement occurring within the site will be a primary focus of future studies.

Surface manifestation of liquefaction will vary depending on the thickness of liquefiable layers, the thickness of a non-liquefiable cap, and other factors. Surface manifestation could consist of surface settlements, sand boils, and ground fissures. Based on our preliminary evaluation using Reference No. 9, the risk for seismically induced liquefaction along the southern portions of the property may be lower since this part of the site is underlain by formational materials at a shallow depth. In addition, it is estimated that the thickness of potentially liquefiable alluvium beneath the compacted fill in this area would relatively limited. It should be noted, however, that there still may be a potential for differential settlement if liquefaction occurs.

If future studies identify liquefiable soils, mitigation will be necessary for settlement-sensitive structures. Typically, structural mitigation would consist of deep foundations extending through the liquefiable layers into deep, non-liquefiable soils at depth. It may also be possible to design the proposed structures and improvements to accommodate the estimated settlement. As an alternative, ground improvement can be used to densify existing soils. Typical ground improvement techniques for liquefaction include stone columns, vibrocompaction, compaction grouting, and deep dynamic compaction.

The potential for lateral spreading due to liquefaction at the site is considered relatively low and would be confined to soil adjacent to the drainage channel and highway embankment.

5.4 Tsunamis and Seiches

A tsunami is a series of long-period waves generated in the ocean by a sudden displacement of large volumes of water. Causes of tsunamis include underwater earthquakes, volcanic eruptions, or offshore slope failures. The first order driving force for locally generated tsunamis offshore of southern California is expected to be tectonic deformation from large earthquakes (Legg, *et al.*, 2002). The largest tsunami effect recorded in San Diego since 1950 was May 22, 1960, which had a maximum run-up amplitude of 2.1 feet (0.7 meters) [URS, 2004]. Wave heights and run-up elevations from tsunami along the San Diego Coast have historically fallen within the normal range of the tides. The County of San Diego Hazard Mitigation Plan maps zones of high risk for tsunami run-up for coastal areas throughout the county. The site is not included in the high risk hazard area. Due to the relative elevation of the site compared to sea level and distance to the Pacific Ocean, the potential for tsunamis impacting the site is low.

Seiches are caused by the movement of an inland body of water due to the movement from seismic forces. The County of San Diego Hazard Mitigation Plan maps zones of high risk for dam inundation areas throughout the county. The site is not included in the high risk hazard area. The potential of seiches to occur is considered to be very low due to the absence of a nearby inland body of water.

5.5 Mineral Resources

The subject property is currently developed to support an active regional shopping center with the anchor stores and mall complex located in the central portion of the site with surface parking lots surrounding the mall. The proposed improvements are planned within the existing shopping center property boundaries and generally within the existing parking lots. From a geologic standpoint, the site is underlain by either Santiago Formation or compacted fill over alluvium. The site was originally marshland terrain that was reclaimed in the late 1960's for the shopping center construction.

As part of our evaluation, we reviewed the report entitled *Mines and Mineral Resources of San Diego County, California (County Report 3)*, published in 1963 by the California Division of Mines and Geology. The report indicates that a salt producing operation was present near or beneath the current shopping center in 1901 through 1902. The mining process consisted of drilling 30 to 50 foot deep wells into the lagoon and pumping the salt brine into evaporating ponds. Since the site has already been developed to support the existing improvements, and future improvements are relatively minor, it is our opinion that loss of availability of a locally important mineral resource is relatively low.

5.6 Slope Stability

No major cut or fill slopes are planned. Based on our visual observations and experience with similar soil and geologic conditions, the existing slopes should be grossly and surficially stable with respect to deep-seated instability and shallow sloughing conditions.

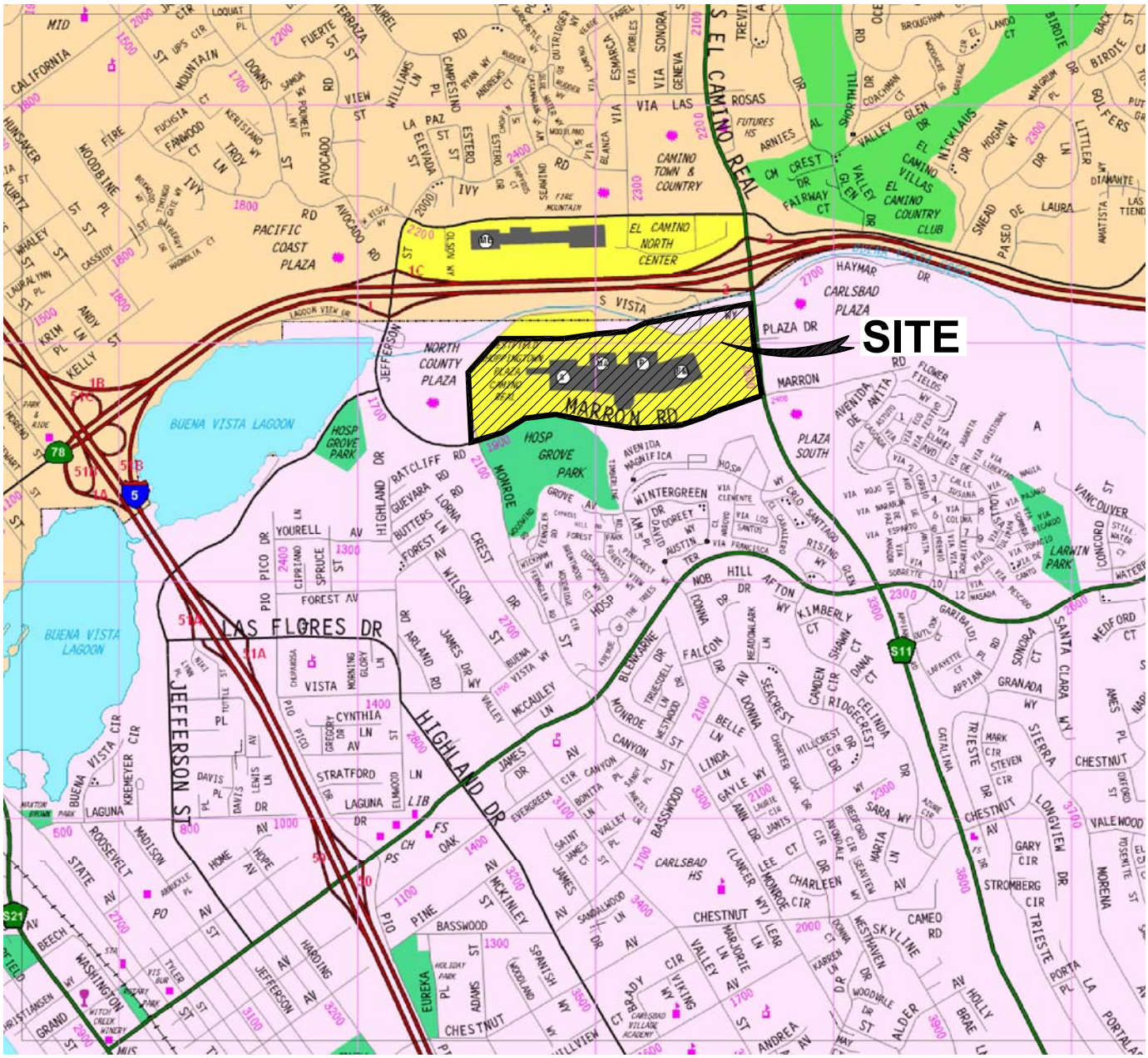
5.7 Remedial Grading

Remedial grading recommendations will be developed as part of the future geotechnical investigation and will be dependent on the results of the liquefaction analysis, mitigation method, and foundation system used. Typical remedial grading measures may consist of removing and replacing the upper approximately 3 feet of finish grade soils with properly placed compacted fill.

6. FUTURE GEOTECHNICAL INVESTIGATION

A geotechnical investigation will be necessary to evaluate the subsurface conditions at the site and to provide recommendations for design and construction of the proposed improvements. The scope of the geotechnical investigation should include performing a subsurface investigation, laboratory testing, and engineering analyses and include an evaluation of the subsurface geologic conditions, the

presence of geologic hazards, including liquefaction and seismically-induced settlement potential, and the geotechnical aspects of developing the property. The report should include recommendations regarding remedial grading, earthwork grading considerations, ground improvement options, foundation options, concrete slabs and flatwork, preliminary pavement design, retaining walls, and site drainage.



SOURCE: 2007 THOMAS BROTHERS MAP
SAN DIEGO COUNTY, CALIFORNIA

N

NO SCALE

GEOCON
INCORPORATED
GEOTECHNICAL CONSULTANTS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

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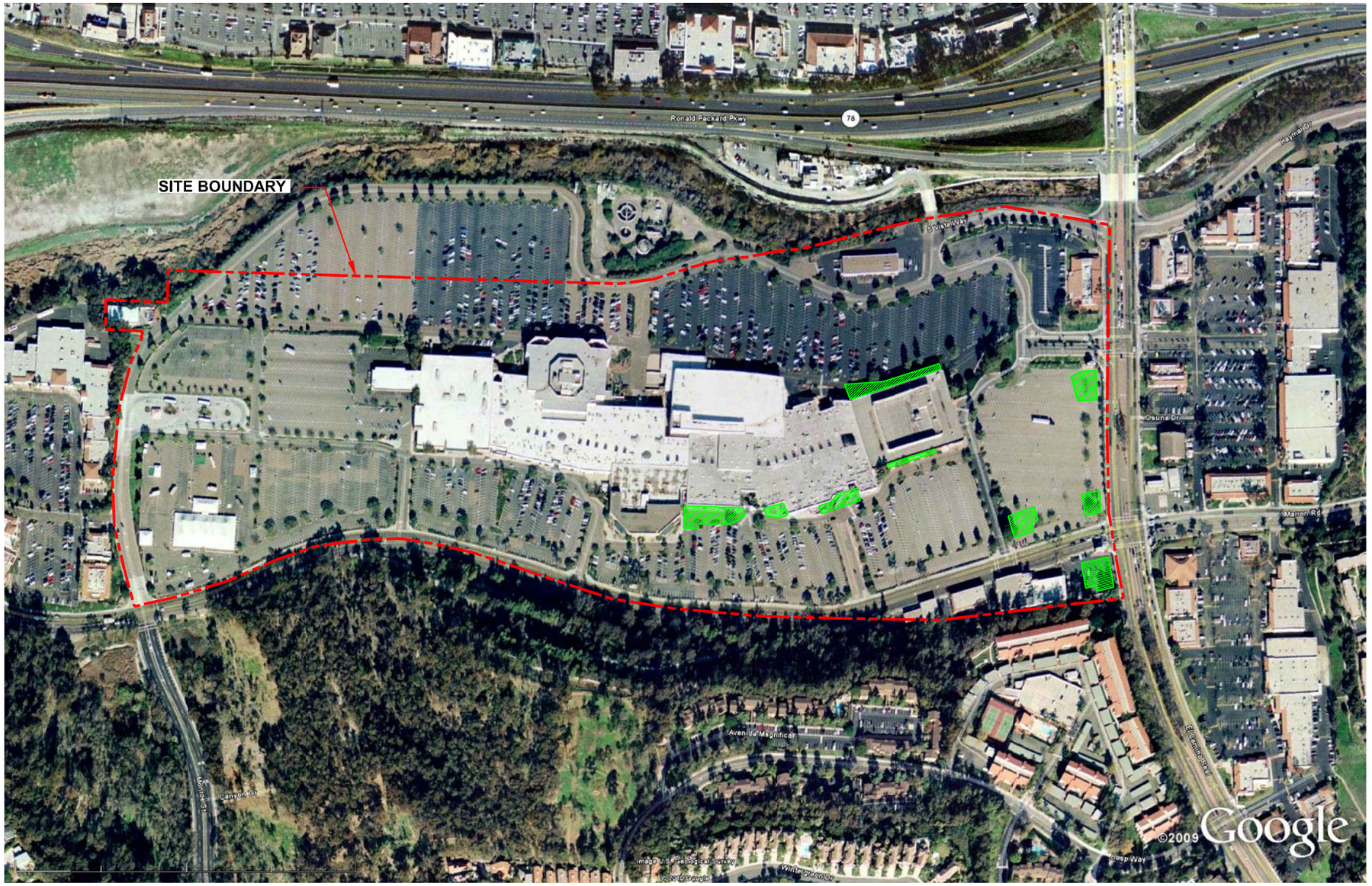
VICINITY MAP

PLAZA CAMINO REAL
SHOPPING CENTER REVITALIZATION
CARLSBAD, CALIFORNIA

DATE 01 - 28 - 2010	PROJECT NO. G1180 - 32 - 01	FIG. 1

PLAZA CAMINO REAL
SHOPPING CENTER REVITALIZATION
CARLSBAD, CALIFORNIA



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LEGEND

.....APPROX. LOCATION OF PROPOSED IMPROVEMENTS

GEOCON INCORPORATED
GEOTECHNICAL CONSULTANTS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

PROJECT NO. G1180 - 32 - 01
FIGURE 2
DATE 01 - 28 - 2010

SITE PLAN

G1180-32-01_SITE PLAN_FIG2_TM

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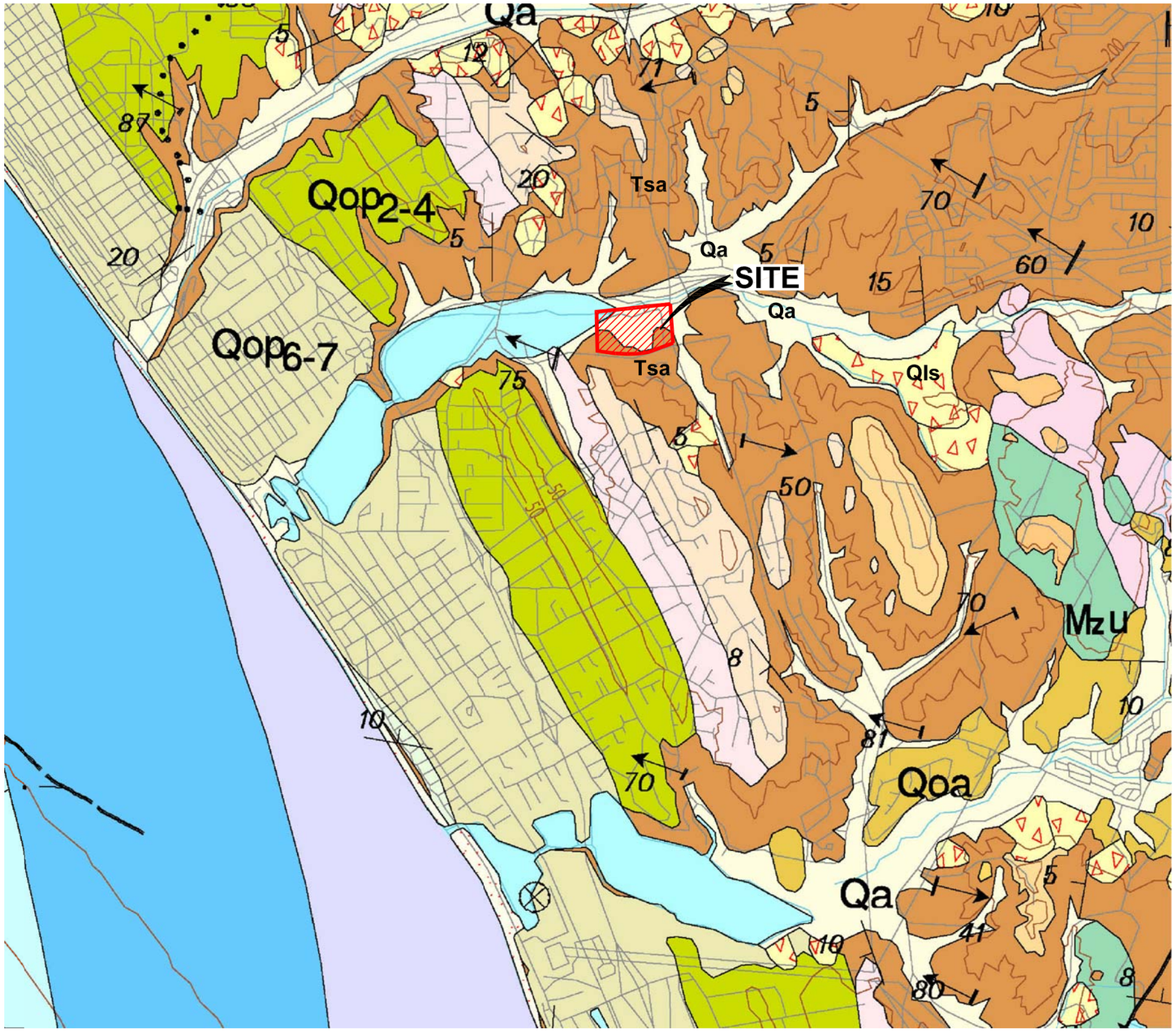
PLAZA CAMINO REAL
SHOPPING CENTER REVITALIZATION
CARLSBAD, CALIFORNIA



SOURCE: Kennedy, MP and S.S. Tan, 2005
Geologic Map of the Oceanside 30'x60' Quadrangle, California

LEGEND

Contact—Contact between geologic units; dotted where concealed.

Fault—Solid where accurately located; dashed where approximately located; dotted where concealed. U = upthrown block, D = downthrown block. Arrow and number indicate direction and angle of dip of fault plane.

Strike and dip of beds

Inclined

Qa — **Alluvial flood plain deposits (late Holocene)**—Active and recently active alluvial deposits along canyon floors. Consists of unconsolidated sandy, silty, or clay-bearing alluvium. Does not include alluvial fan deposits at distal ends of channels

Qls — **Landslide deposits undivided (Holocene and Pleistocene)**—Highly fragmented to largely coherent landslide deposits. Unconsolidated to moderately well consolidated. Most mapped landslides contain scarp area as well as slide deposit. In some areas scarp is shown separately. Many Pleistocene-age landslides were reactivated in part or entirely during late Holocene. Most of the landslides in the quadrangle have occurred within the Capistrano Formation, however, there are many within the Monterey and Santiago formations as well

Tsa — **Santiago Formation (middle Eocene)**—Named by Woodring and Popenoe (1945) for Eocene deposits of northwestern Santa Ana Mountains. There are three distinctive parts. A basal member that consists of buff and brownish-gray, massive, coarse-grained, poorly sorted arkosic sandstone and conglomerate (sandstone generally predominating). In some areas the basal member is overlain by gray and brownish-gray (salt and pepper) central member that consists of soft, medium-grained, moderately well-sorted arkosic sandstone. An upper member consists of gray, coarse-grained arkosic sandstone and grit. Throughout the formation, both vertically and laterally, there exists greenish-brown, massive claystone interbeds, tongues and lenses of often fossiliferous, lagoonal claystone and siltstone. The lower part of the Santiago Formation interfingers with the Delmar Formation and Torrey Sandstone in the Encinitas quadrangle

GEOCON
INCORPORATED
GEOTECHNICAL CONSULTANTS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

PROJECT NO. G1180 - 32 - 01
FIGURE 3
DATE 01 - 28 - 2010

REGIONAL GEOLOGIC MAP

G1180-32-01_TM_Regional Geologic Map_FIG3

LIST OF REFERENCES

1. Aerial Photographs (AXN 14M-20, and AXN 14M-21, dated May 2, 1953).

2. Blake, *EQFAULT, A Computer Program for the Deterministic Prediction of Peak Horizontal Acceleration from Digitized California Faults*, User's Manual, 1989a, p. 79.

3. County of San Diego, Office of Emergency Services, *Multi-Jurisdictional Hazard Mitigation Plan, 2010 (Draft), www.sdcounty.ca.gov/emergency_mangement/oes_jl_mitplan.html*.

4. Jennings, C. W., 1994, California Division of Mines and Geology, *Fault Activity Map of California and Adjacent Areas,* California Geologic Data Map Series Map No. 6.

5. Kennedy, M. P. and S. S. Tan, 2005, *Geologic Map of the Oceanside 30'x60' Quadrangle, California*, USGS Regional Map Series Map No. 3, Scale 1:100,000.

6. *Landslide Hazards In The Northern Part of the San Diego Metropolitan Area, San Diego County, California*, California Division Of Mines And Geology, Open File Report 95-04 (1995).1953 stereoscopic aerial photographs of the site and surrounding areas.

7. United States Geological Survey, *7.5 Minute Quadrangle Series* San Luis Rey Quadrangle, 1968, photo revised 1975.

8. Unpublished reports and maps on file with Geocon Incorporated.

9. Woodward-Clyde Consultants, *Geotechnical Investigation, Plaza Camino Real Expansion, Carlsbad, California*, dated September 17, 1975 (Project No. 75-173).

Project No. G1180-32-01
April 27, 2010

Helix Environmental Planning, Inc.
7578 El Cajon Boulevard, Suite 200
La Mesa, California 91942

Attention: Ms. Kim Baranek

Subject: PLAZA CAMINO REAL SHOPPING CENTER REVITALIZATION
CARLSBAD, CALIFORNIA
ADDENDUM TO GEOTECHNICAL RECONNAISSANCE REPORT

Dear Ms. Baranek:

In accordance with your request, we have prepared this addendum to our report entitled *Geotechnical Reconnaissance Report, Plaza Camino Real Shopping Center Revitalization, Carlsbad, California*, dated January 28, 2010. The addendum, Figure 4 attached, is a site plan presenting the estimated project location on an enlarged version of the map entitled *County of San Diego, Office of Emergency Services, Multi-Jurisdictional Hazard Mitigation Plan, 2010 (Draft).*

Should you have questions regarding this addendum, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Trevor E. Myers
RCE 63773

REGISTERED PROFESSIONAL ENGINEER
TREVOR E. MYERS
No. RCE63773
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CIVIL
STATE OF CALIFORNIA

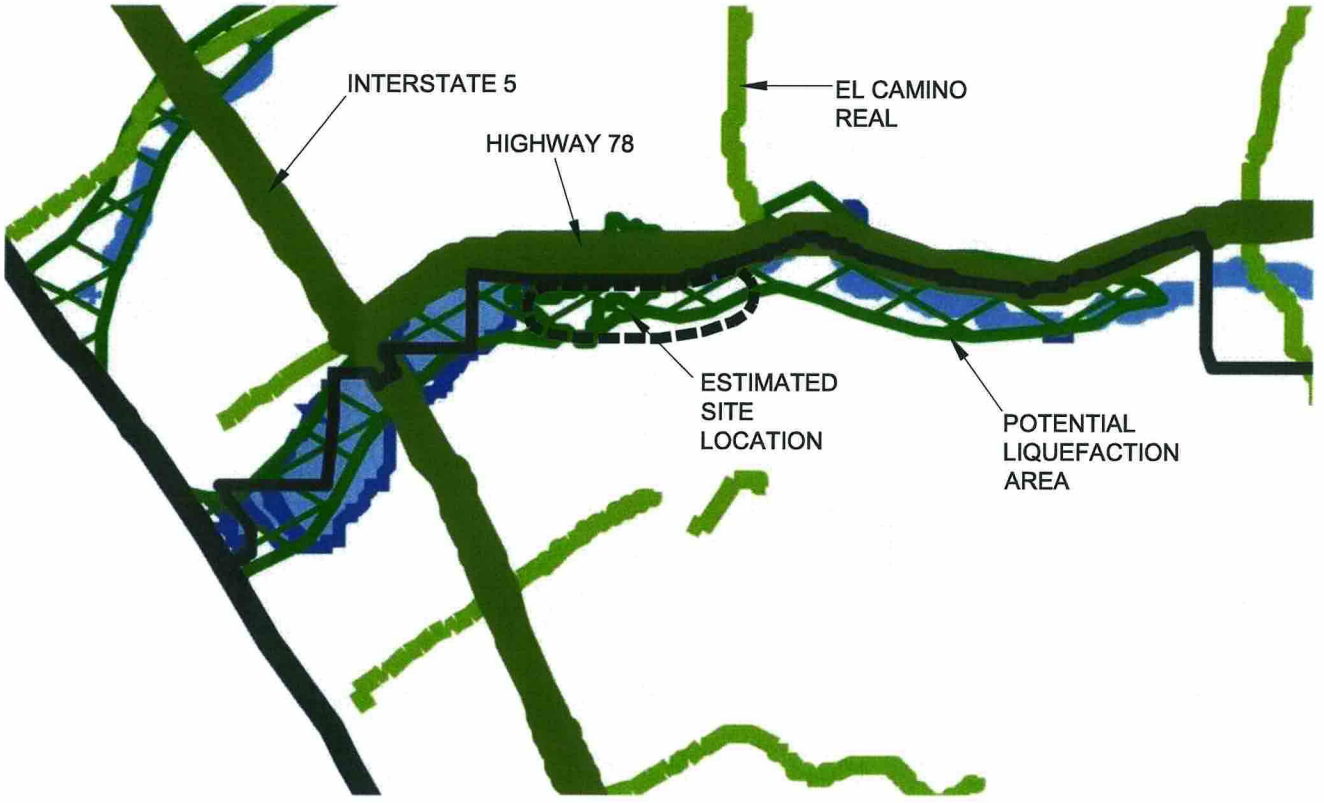
David B. Evans
CEG 1860

PROFESSIONAL GEOLOGIST
DAVID B. EVANS
No. 1860
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

TEM:DBE:dmc

Attachment: Figure 4 – Liquefaction Hazard Map

(4) Addressee



SOURCE: COUNTY OF SAN DIEGO MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN (SEE REPORT REFERENCE NO.3)

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NO SCALE

GEOCON INCORPORATED
GEOTECHNICAL CONSULTANTS
6960 FLANDERS DRIVE-SAN DIEGO, CALIFORNIA 92121-2974
PHONE 858 558-6900 - FAX 858 558-6159

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LIQUEFACTION HAZARD MAP

PLAZA EL CAMINO REAL
SHOPPING CENTER REVITALIZATION
CARLSBAD, CALIFORNIA

DATE 04 - 27 - 2010	PROJECT NO. G1180 - 32 - 01	FIG. 4

G1185-32-01_SITEPLAN_FIG4_TM